EuroAmerican Journal of Applied Linguistics and Languages
E-JournALL, Volume 5, Issue 1, August 2018, 1-26
ISSN 2376-905X
http://doi.org/10.21283/2376905X.8.128

¡Ya pué[h]! Perception of coda-/s/ weakening among L2 and heritage speakers in coastal Ecuador

CHELSEA ESCALANTE*
University of Wyoming

Received 22 February 2018; received in revised form 21 May 2018; accepted 29 June 2018

ABSTRACT

EN This investigation lies at the intersection of second language acquisition (SLA), sociophonetic variation, and speech perception. Specifically, it investigates the perception of coda /s/-aspiration (producing *disco* as [dih.ko]), a dialectal feature characteristic of *Guayaquileño* (coastal Ecuadorian) Spanish, among 14 young-adult English speakers who travel to Ecuador. The study investigates the participants' ability to perceive an aspirated variant as a legitimate /s/ over time as they are further exposed to the local variety. It also explores the linguistic and extralinguistic factors that play a role in the perception of the variable such as phonological context of /s/, proficiency level, and individual differences in experience with /s/-weakening dialects. Results suggest that most learners are able to acquire new mappings within their interlanguage phonological system. However, results vary according to proficiency, phonological context of /s/, and at the individual level. The results also suggest that gains in sociolinguistic competence can be seen in terms of perception (as opposed to only in learner production), which underscores the necessity to include perceptual studies in future research in variationist SLA.

Key words: SECOND LANGUAGE ACQUISITION, PERCEPTION, DIALECTAL VARIATION

ES Este estudio se enmarca en la adquisición de segundas lenguas, la variación sociofonética y la percepción del habla. Más concretamente, investiga la percepción de la aspiración de /s/ en posición final de sílaba (la producción de *disco* como [dih.ko]), un rasgo dialectal característico del español *Guayaquileño* (de la costa de Ecuador), por 14 jóvenes adultos de habla inglesa que viajaron a Ecuador. El estudio analiza la habilidad de los participantes de percibir la variante aspirada como /s/ con el paso del tiempo y una mayor exposición a la variedad local. Explora, además, los factores lingüísticos y extralingüísticos que afectan la percepción de la variable, como, por ejemplo, el contexto fonológico de /s/, el nivel de dominio del idioma y las diferencias individuales relacionadas con la exposición previa a dialectos con un debilitamiento de /s/. Los resultados sugieren que la mayoría de los aprendientes son capaces de adquirir nuevas correspondencias dentro del sistema fonológico de su interlingua; sin embargo, muestran mucha variación individual, relacionada con el nivel de dominio de la lengua y el contexto fonológico de /s/. Los resultados sugieren, además, que las mejoras en la competencia sociolingüística de los aprendientes pueden analizarse en términos de percepción y no solamente producción, hecho que destaca la necesidad de incluir estudios perceptivos en las investigaciones futuras de la variación en el ámbito de la adquisición de segundas lenguas.

Palabras clave: ADQUISICIÓN DE SEGUNDAS LENGUAS, PERCEPCIÓN, VARIACIÓN DIALECTAL

IT Questo studio si pone all'incrocio tra acquisizione di seconde lingue, variazione sociofonetica e percezione del linguaggio. In particolare, indaga la percezione di /s/ aspirata in posizione finale di sillaba (la produzione di *disco* come [dih.ko]), una caratteristica dialettale dello spagnolo guayaquileño (della costa dell'Ecuador) da parte di 14 giovani inglesi che sono andati in Ecuador come volontari. Lo studio indaga la capacità dei partecipanti di percepire la variante aspirata come /s/ non aspirata in relazione al passare del tempo e a una maggiore esposizione alla varietà locale. Esplora, inoltre, i fattori linguistici ed extralinguistici che giocano un ruolo nella percezione della variante, come il contesto fonologico di /s/, il livello di competenza linguistica e le differenze individuali basate sull'esposizione a dialetti con indebolimento di /s/. I risultati suggeriscono che la maggior parte degli studenti è in grado di acquisire nuove mappature nel sistema fonologico della loro interlingua. Tuttavia, i risultati variano a livello individuale e in base alla competenza linguistica e il contesto fonologico di /s/. I risultati indicano anche che il miglioramento della competenza sociolinguistica degli studenti può essere analizzato in termini di percezione e non solo di produzione sottolineando la necessità di includere studi percettivi nella ricerca variazionista nell'ambito dell'acquisizione di seconde lingue.

Parole chiave: AQCUISIZIONE DI SECONDE LINGUE, PERCEZIONE, VARIAZIONE DIALETTALE

* Contact: cescalan@uwyo.edu

1. Introduction

Variationist approaches to second language acquisition (SLA) have gained influence in recent years, in part due to their ability to offer quantitative analyses of the interlanguage system using statistical tools that are capable of examining the complex relationships between a wide range of linguistic and social variables (Bayley & Tarone, 2012). These studies are valuable to the field of SLA because they are able to take into account that the linguistic systems of second languages (L2s), like first languages (L1s), are (1) rule-governed, (2) undergo change, and (3) are impacted by social factors (Gudmestad, 2014, p. 81). First applications of the variationist paradigm to SLA (e.g. Adamson & Kovac, 1981; Dickerson, 1974; Ellis, 1987; Tarone, 1988; Young, 1991), later called Type 1 variation by Mougeon, Nadasdi, and Rehner (2004), focused on interlanguage alternations between native-like and non-native-like variants (using monolingual norms as the baseline), or between more than one non-native variant, such as a learner's use of **Do you ate the sandwich?* vs. *Did you drink the milk?*. Studies in Type 2 variation, which emerged a few years later (e.g. Adamson & Regan, 1991; Bayley, 1996; Major, 2004), were concerned with the alternation of non-categorical structures according to native speaker (NS) patterns (sociolinguistic variation). Examples of this type of variation among learners of Spanish would include copula contrast, subject expression, or weakening of coda /s/.

The goal of many of these Type 2 studies is to measure the sociolinguistic competence of L2 speakers, or their knowledge of the sociocultural norms of language and of discourse, vis-a-vis the use of a sociolinguistic variable. This type of competence requires an understanding of the social context in which language is used: the roles of the participants, the information they share, and the functions of the interaction (Muniandy, Nair, Krishnan, Ahmad, & Noor, 2010). The very definition of the sociolinguistic variable, which was originally termed as two or more ways of saying the same thing (Labov, 1972) and later broadened to include two or more ways of expressing the same function, suggests that sociolinguistic competence involves not only the ability to use target-language patterns of variation, but also the competence to realize that the variants in question are mapping to the same variable (i.e. that *máØ*, *máh*, and *más* all mean the same thing). Despite the fact that sociolinguistic competence must involve the ability to comprehend the variable in question, thus far, nearly all of the sociolinguistic studies of SLA have measured how speakers *produce* variable forms. A handful of studies have explored how L2 speakers *perceive* sociolinguistic variants, but significantly more work in this area is necessary to understand how these speakers process multiple forms and create associations between variants. As such, the goal of the current study is two-fold: first, it seeks to determine through a multivariate analysis the factors constraining learner perception of a highly frequent variable form in Spanish: coda /s/-weakening; second, it suggests that sociolinguistic competence can and should be measured not only in terms of how learners produce variable forms but also how they perceive and process such forms.

In this study, /s/-weakening was chosen for several reasons. First, few topics in Spanish sociolinguistics have received as much attention as syllable-final /s/-weakening (i.e. Brown, 2008; Bybee, 2002; Erker & Otheguy, 2016; File-Muriel, 2007; Lafford, 1986; Lipski, 1985; 1999; Poplack, 1986; Terrell, 1978; 1979, among others). As such, there is plenty of information available as to the linguistic and social factors that constrain the production of the variable that can be used as a point of comparison in studies of perception. Secondly, due to its extensive social and geographic variability in the Spanish-speaking world, it is likely that L2 speakers will come in contact with the variable at some point during their acquisitional journey. Because of that likelihood, it is important to understand how learners acquire the sociolinguistic competence to map weakened forms to /s/ – how they come to understand, for example, that *máØ*, *máh*, and *más* all carry the same function. Third, coda /s/ carries significant morphological information in Spanish, increasing the necessity for learners to accurately interpret it. Fourth, whereas other sociolinguistic variables are quite salient and arguably easier for learners to notice (*tú*/*voseo*, copula contrast, Argentine *sheísmo*, and the use of θ in Spain), /s/-weakening can be characterized as a less salient variable that is both difficult for learners to comprehend (Trimble, 2011) and also requires a re-mapping of the L1 English phonological system which typically does not allow for aspiration or deletion of syllable-final sibilants, except for in the case of inflectional /s/ in some English dialects.

This study is based on data collected from a group of 14 young adults (all L1 speakers of English) from distinct parts of the United States who travel to Guayaquil, Ecuador to work as long-term volunteers for a humanitarian non-governmental organization (NGO) for a period of twelve months. It explores the volunteers' perception of /s/-weakening in a longitudinal manner, quantitatively measuring their ability to map [h] to /s/ via a perception task at six different intervals throughout their year in Ecuador. Data was

submitted for multivariate analysis to Rbrul (Johnson, 2009) to measure the relative strength of factors influencing the participants' ability to perceive [h] as a legitimate variant of /s/.

2. Background and motivation

2.1. Status of /h/ and /s/ in English and Spanish

Although perhaps best described as a sub-segmental gradient phenomenon (Erker, 2010), most research on Spanish /s/-weakening has used a tri-part labeling system – retention [s], aspiration [h], or deletion [Ø]– to distinguish between the innumerable phonetic manifestations of /s/ (Lafford, 1986). English has a phoneme /h/ (as in *house*) that is traditionally described as a voiceless glottal fricative, similar to the aspirated variant of /s/ in Spanish, [h]. However, although there are similarities between English /h/ and Spanish [h], the two phones differ in terms of the syllable position in which it occurs (and is contrastive) as well as the phonemes to which [h] is associated (Schmidt, 2011, pp. 19-20). In English, /h/ is contrastive in syllable-initial position (*house*/*mouse*, *hot*/*ought*), but is not found in coda position, while Spanish [h] is not contrastive and, with the exception of some dialects, appears in syllable-final position. Since glottal fricatives do not occur in coda position in English, it may be the case that L1 English speakers do not perceive the aspirated variant in Spanish, at least at the beginning stages of acquisition (Schmidt, 2011, p. 20). In Spanish, [h] is an allophone of /s/, but in English, [h] typically does not appear as a surface representation of the English phoneme /s/. As Schmidt (2011, p. 21) states, in order to perceive /s/-weakening, not only do L1 English L2 Spanish speakers "need to acquire the perception of a phonetically similar sound in a new phonetic context, [but] they must also come to recognize [h] as a legitimate variant of a different phonemic category, /s/".

Figure 1 illustrates the variability of /s/-production within a single phrase extracted from an interview of a NS of coastal Ecuadorian Spanish. In this phrase, *las personas* 'the people', the first coda /s/ is weakened, visible by the shorter duration of the frication segment and lack of concentrated high frequency energy on the spectrogram. In *personas*, coda /s/ is retained, visible by the longer duration and concentrated high frequency frication. Thus, an L1 English - L2 Spanish speaker hearing this utterance would need to acquire the perception of [h] in a new context (syllable-final) while realizing that [h] pertains to /s/ instead of /h/.

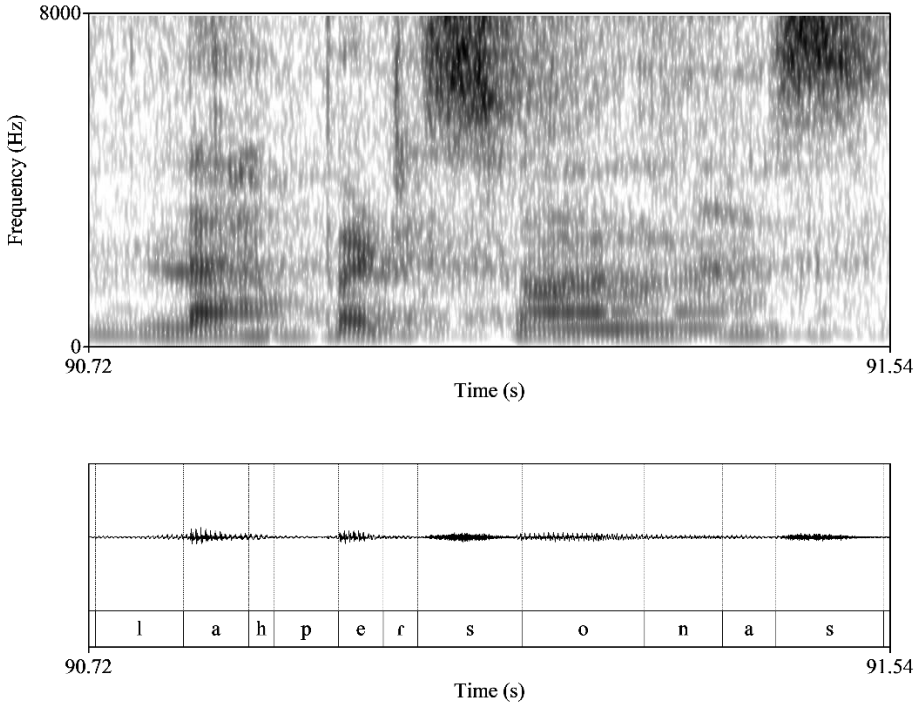

Figure 1. Coastal Ecuadorian NS producing *las personas* (the people)

2.2. Previous studies on the production of /s/-weakening

Although there has been very little research on /s/-weakening among L2s and HLLs, this topic has been studied prolifically among NSs. Most research has shown that the main linguistic factor that constrains /s/-lenition within a given speech community and speech style is following phonological context. According to Lipski (1999), at the first stage of weakening, /s/ is produced as the glottal fricative [h] before a consonant both within and between word boundaries (*las mesas* [lah mé.sas] 'the tables', *hasta* [áh.ta] 'until') but retains its sibilance and is produced as [s] phrase-finally and before vowels[1]. In the second stage, syllable-final /s/-weakening extends to all syllable-final contexts, including phrase-final (*vamos* [bá.moh] 'let's go'), while retaining word-final prevocalic /s/ as [s] (*es así* [es a.sí] 'that's how it is'). In the third stage, weakening advances to include word-final prevocalic /s/, and in the fourth stage of /s/-lenition, all word-final sibilants are realized as [h], regardless of the nature of a following segment (p. 198). Lipski also hypothesizes that speakers that aspirate or delete in one of the latter contexts will also lenite in the former contexts. Large-scale empirical studies such as those of File-Muriel (2007) and Terrell (1978) on Colombian and Caribbean varieties of Spanish, respectively, as well as small-scale work on coastal Ecuadorian Spanish (Escalante, 2016) have shown phonological context to be a robust predictor of /s/-weakening, with pre-consonantal contexts generally favoring lenition more so than pre-vocalic and pre-pausal contexts.

A second linguistic factor that has been found to constrain /s/-weakening is lexical frequency. Exemplar theory and usage-based phonology typically claims that high-frequency lexical items undergo regular sound change at an accelerated rate compared to low-frequency words[2]. Using data from Argentine and Cuban Spanish (Terrell, 1979), Bybee (2000) argued for a usage-based approach to /s/-lenition, suggesting that if usage affects stored representation and if twice as many tokens begin with a consonant than with a vowel, phonetic changes conditioned by a following consonant will also take place at a word-boundary, though at a slower rate than word internally where the environment does not alternate. Brown (2008) explored word-internal and word-final /s/ reduction in three dialects of Spanish (Cali, Colombia, Mérida, Venezuela, and San Juan, Puerto Rico) and found that high-frequency words significantly conditioned final /s/ reduction in dialects with lower rates of overall reduction (Cali, Colombia and Mérida, Venezuela), but not in dialects with higher rates of reduction (San Juan, Puerto Rico). File-Muriel (2009) has also shown frequency to be a significant predictor of weakening in Colombian Spanish as has Fox (2006) in several Latin American dialects. Other research, on the other hand, has called into question the degree to which frequency has been claimed to affect variation (Abramowicz, 2007; Bayley, 2014; Bayley, Greer, & Holland, 2017; Labov, 2010; Martínez-Sanz & van Herk, 2013; Tamminga, 2014). Bayley (2014) has shown that frequency has at most a minimal effect in cases of stable variation and claims that the "absence of consistent effects for frequency in the variables suggests that the role of frequency in language variation and change has been considerably overestimated." In support of this line of research, lexical frequency was not found to be a significant predictor of /s/-weakening in a small pilot study of coastal Ecuadorian Spanish (Escalante, 2016).

A number of studies on coda /s/ have also found prosodic stress to influence lenition. Brown and Cacoullos (2003), Poplack (1980), and Terrell (1978) have all found higher rates of weakening in unstressed environments. In coastal Ecuadorian Spanish, stress was found to be a significant predictor of weakening in spectral terms (center of gravity [COG]) but not in temporal terms (frication duration)[3]. Like in previous research, unstressed syllables demonstrated a lower COG (mean = 1556hz) than stressed (mean = 1726hz) (Escalante, 2016).

Lastly, the number of syllables in a word has been found to influence lenition in a number of studies across several geographic regions. Lipski (1984), Barrutia and Terrell (1982), Cepeda (1995), Lafford (1989), and Terrell (1978) have all found evidence of higher degree of /s/-maintenance in monosyllabic words than polysyllabic words. In coastal Ecuadorian Spanish (Escalante, 2016), the same pattern was found, but only for COG; as the number of syllables increased, COG decreased by 118.003hz. The number of syllables was not found to be a significant predictor of weakening in temporal terms, however.

---

[1] This is typically considered a product of *sinalefa* (linking), or the tendency for prevocalic coda /s/ to be resyllabified to the onset of the following syllable.

[2] Although this is generally true, according to Bybee (2007), high frequency can also have a conserving effect. Bybee (2007, p. 29) uses the examples of low-frequency past tense verbs with a lax vowel such as *lept*, *wept*, and *dreamt* tend to be regularized to **leaped*, **weeped*, and **dreamed* more so than their high-frequency counterparts *slept*, *left* and *kept* (rarely regularized to **sleeped*,* *leaved*, and **keeped*).

[3] COG measures the frequency at which sonic energy is maximally concentrated (Erker, 2010). There is more evidence of /s/-weakening as measurements of COG and frication duration decrease.

Within Spanish-speaking communities, in addition to the linguistic constraints mentioned above, variation in the distribution of /s/ has also been explained in terms of varying sociolinguistic characteristics of the speakers, such as socioeconomic status and education level, age, gender, and whether the speaker resides in an urban or rural location (File-Muriel & Brown, 2011). Aspiration and deletion are generally considered markers of social class, with upper-class and more-educated speakers tending towards less weakening, while lower-socioeconomic class and less-educated speakers favor more lenition (Lafford, 1986; Terrell, 1981). The more advanced stages of /s/-weakening in a particular dialect are also typically found to a greater extent in the speech of males and speakers from lower socioeconomic levels, while females and speakers from higher socioeconomic levels tend to favor less-advanced stages or full sibilance (Dohotaru, 2004; Ruíz-Sanchez, 2004). One notable exception to these patterns was found in the work of Carvalho (2006) who found that on the Uruguayan-Brazilian border, /s/-aspiration is found to be a prestige marker, rather than a stigmatized variant, used as a result of a desire to accommodate more closely to the speech of Montevideo.

2.3. Previous studies on the perception of /s/-weakening

Perceptual studies relating to Spanish coda /s/ are far more rare than production studies, both for NS as well as for L2 listeners. Regarding how NSs process /s/-weakening, Figueroa (2000) and Hammond (1978) found that NSs of Caribbean varieties were able to distinguish between word-internal /s/-elision and complete absence of /s/ (as in *pastilla* [paØ.tí.ja] 'pill' versus *patilla* [pa.ti.ja] 'sideburn'), but were not able to distinguish between elided-/s/ and no /s/ in word-final position (as in *hagas* [á.ɣaØ] versus *haga* [á.ɣa]), highlighting the degree of difficulty that even NSs face when perceiving /s/-weakening in isolated words with little to no contextual clues.

A few studies have looked at the perception of NS /s/-weakening by L2 listeners, some focusing solely on /s/-weakening and others focusing on the comprehensibility of a specific dialect that contains /s/-weakening along with other sociolinguistic variables. Schmidt (2009) explored gains made in comprehension of Dominican Spanish among 11 adult learners over the course of a three-week stay in the Dominican Republic, measuring how L2s progressed in their comprehension of four local features: /s/-weakening, intervocalic /d/-weakening, lambdacism (variation between syllable-final liquids /ɾ/ and /l/), and /n/-velarization. Participants did improve their global comprehension abilities over the course of the stay, yet deletion of coda /s/ and lambdacism was found to impede comprehension to a greater extent than did deletion of word-final /d/ or /n/-velarization, suggesting that different phonological features of Dominican Spanish have different effects on the comprehension of the dialect.

Studying the effect of phonetics training on dialect comprehension, Rasmussen & Zampini (2010) explored how L2 speakers improved their comprehension of Andalusian Spanish (a dialect characterized by /s/-weakening, among other features) with and without explicit training on the target dialect. The authors found significant rates of improvement in comprehension of weakened /s/ after exposure; however, the difference in improvement between the control group and the experimental group did not reach statistical significance, therefore not supporting the hypothesis that explicit instruction aids in the ability to comprehend /s/-weakening.

Schmidt (2011) examined how 47 NSs of Spanish from aspirating and non-aspirating dialects and 215 English-speaking learners of Spanish with varying experience with the target language (TL) identified and processed tokens of syllable-final, word-internal aspirated /s/. Specifically, she found that the L2 learners demonstrated development in the perception of the dialectal feature, with identification of aspiration as a variant of /s/ first emerging at the intermediate-low level. By the most advanced levels, L2 learners showed native-like patterns of perception of the aspirated variant. The location of study abroad experience was found to play a significant role in perception of the aspirated /s/, with greater acceptance of the aspirated variants as legitimate forms of Spanish /s/ among those learners with prior experience in /s/-weakening regions.

George (2014) investigated L1 English speakers' perception of /s/-weakening in beginning, intermediate-low, and advanced Spanish courses in order to determine if and how L2 Spanish learners perceived /s/-weakening. Results indicated that learners of Spanish do perceive /s/-weakening, but the extent of this perception varies based on the level of the Spanish course, with advanced learners perceiving aspiration more than beginning learners. She also found that learners most often associated aspiration with nothing (i.e. processing pa[h]ta as *pata* rather than *pasta*).

Lastly, Bedinghaus (2015) studied the perception of /s/-weakening among students sojourning in Andalusia (an /s/-weakening region) and at-home learners, finding that abroad learners were more successful at perceiving weakened variants than their peers at home.

2.4. Heritage language learners and dialectal variation

Often the prototypical heritage language learner (HLL) is conceived as an individual whose parents are first-generation immigrants and NSs of the heritage language (HL). The HLL then grows up in an environment where the minority language is spoken in the home by both parents and the majority language (English, in the context of the United States) is used in public spaces and eventually becomes the dominant language of the HLL. As Potowski (2013, p. 405) explains, the primary distinguishing factor between L2s and HLLs of Spanish in the United States is that HLLs are exposed to Spanish starting at birth from their family members, while L2 speakers typically acquire the language later and in a classroom environment, while the primary differentiating factor between HLLs and "homeland" speakers (or NSs) is that HLLs "spend a portion of their prime language-learning years immersed in an English-speaking environment" (p. 405). She explains that HLLs generally receive input in Spanish in the home, sometimes exclusively, but sometimes combined with exposure to English until they enter preschool or kindergarten. Upon entering school, then, the amount of English input increases drastically, while Spanish typically remains confined to the domestic and community domains, resulting in HLLs typically not having "the same exposure to the wide variety of linguistic and social experiences that a homeland speaker [does], usually resulting in a different linguistic system" (p. 405). Yet despite these common traits, most scholars of HL linguistic systems agree that there is great heterogeneity among individuals categorized as HLLs. According to Potowski (2013), these individuals can vary along the following five dimensions, some of which overlap in different ways: historical (generation of immigration), linguistic (age of onset of bilingualism, domains of language use, and level of prestige of variety), educational (extent of formal education in Spanish), affective (learner identity), and cultural (family practices, maintenance, and use).

Compared to research on the adoption of variable features by L2 speakers, there is relatively little information regarding how HLLs encounter new dialects in immersion contexts. Unlike L2s, who enter an immersion zone as newcomers, HLLs who participate in immersion experiences in their ancestral country (or even region) of origin may already have some degree of familiarity with the language and culture of the host country due to their family background (Shively, 2016). Also unlike L2 learners, HLLs may have a personal connection to the host country or region and may choose that location in order to learn more about their cultural backgrounds or families (Moreno, 2009; Rubin, 2004; Shively, 2016; Van Der Meid, 2003). HLLs are more likely to begin their immersion experience with stronger linguistic and cultural knowledge than L2 learners as well as greater familiarity with using their HL outside of the formal classroom setting (Davidson & Lekic, 2013; Petrucci, 2007; Potowski, 2002; 2013).

However, it is suggested that HLLs may encounter an even more complex dilemma in their experience with a secondary dialect than L2 speakers. First, since HLLs often arrive to the immersion zone with an established home dialect, they may face conflicting desires to assert their identity as an HLL of a particular background—maintaining their home-dialect features—and becoming an active participant in the target culture and acquiring/accommodating to new features. Secondly, HLLs must also navigate the social ramifications of the use of new features. Since not all Spanish dialects are of equal prestige, depending on the background of the HLL, his/her home variety may be stigmatized in the immersion zone, causing him/her to potentially encounter linguistic discrimination (Moreno, 2009; Riegelhaupt & Carrasco, 2000). Thirdly, since HLLs from the same ancestral background as the immersion zone are often positioned as members of the host culture, they may be held to monolingual norms, assumed to have insider cultural knowledge, and expected to behave according to the cultural expectations of the host country. If they do not meet these expectations, there may be negative consequences such as judgements of social error more so than their L2 peers (Petrucci, 2007; Shively, 2016). Finally, in terms of perception, HLLs may have to re-map an established phonological system which may in some ways be less malleable than an L2 system. In the case of /s/-weakening, speakers from a maintaining dialect may have difficulty perceiving variants ranging from [h]-Ø as legitimate variants of /s/. To my knowledge, no research has systematically explored how HLLs perceive and process dialectal phonological variation in Spanish, though the work of Kim (2012; 2015), has explored other phonological features of HLL speech. Her research on the perception of VOT among HLLs and NSs of Spanish found that HLLs tended to perceive VOT contrasts in voiceless stops similarly to Spanish NSs, even though they did not produce the contrasts as NSs did (Kim, 2012). Kim (2015) investigated the perception of lexical stress in

Spanish among different generations of HLLs and suggests that speakers whose families have had a longer presence in the United States tend to pattern like NSs of English while those with a shorter presence pattern more similarly to NSs of Spanish.

2.5. Research questions

The above-mentioned studies have offered valuable information regarding the perception of /s/-weakening among L2s. The current study seeks to add to this foundation by exploring the perception of the variable in longitudinal terms at several intervals to understand the process of acquisition over time. It also considers /s/ at the four different phonological contexts rather than only in word-internal position as previous studies have done. Lastly, it includes HLLs in the participant pool and offers an analysis of the differences seen in their perception of /s/ as compared to that of L2 speakers. The study addresses the following research questions:

1. How do speakers of Spanish as an L2 and as a HL perceive weakened forms of /s/?
2. What is the role of phonological context, time-in-country, proficiency, and individual differences in their ability to perceive aspirated variants as legitimate variants of /s/?

3. Methods

3.1. Participants

As seen in Table 1, the participant group was comprised of 14 full-time volunteers (9 females, 5 males) who ranged in age from 22-26 years. All were recent college graduates from different parts of the United States with varying degrees of experience in international travel as well as in Spanish language proficiency. All had received some formal language instruction in Spanish, but that training varied from 2-10 years. Most had spent at least some time abroad in Spanish-speaking countries, with four having four or more months of experience in another country via study abroad (3 participants) or permanent residence (1 participant).

Three participants were considered HLLs: one participant was born in Quito, Ecuador (a widely /s/-maintaining dialect) and lived there until age nine at which time he immigrated to Sacramento, CA; one participant was half-Colombian (her mother is from the /s/-conserving Colombian highland region) and raised in New York; the third was unsure of her biological heritage because she was adopted, but she considers herself half-Mexican (the maternal side of her adoptive family is of Mexican descent) and she spoke some Spanish at home, mainly with her grandmother who was a monolingual Spanish speaker. The remaining eleven participants acquired Spanish mainly in the classroom environment. Based on their initial overall Versant Oral Proficiency test scores[4] and their context of learning, participants were grouped into four proficiency levels: novice-mid/high, intermediate-low, intermediate-mid, and HLLs.

3.2. Setting

The participants' volunteer year began in August of 2015 and concluded in the same month of 2016. Upon arrival, the participants were split into two volunteer houses in two socioeconomically marginalized districts of Guayaquil. Participants worked in their communities in different educational and social work capacities during the day but their primary goal was to live in community, poverty, and solidarity alongside their neighbors. Because of the outward focus of the organization, participants spent the majority of their time outside with Spanish-speaking neighbors and co-workers. They returned to the volunteer houses in the evenings, where they typically spoke English, but also participated in neighborhood functions some evenings and nearly all weekends where they interacted with Ecuadorians nearly exclusively in Spanish.

[4] The *Versant Spanish Test*, which is based on Levelt's (1989) model of speech production, uses spoken prompts in Spanish of NSs from a variety of Spanish-speaking countries to elicit oral responses from students. It has been tested for validity and correlates with other proficiency measures (Pearson, 2011). This test was chosen because it provides nearly instantaneous, objective, reliable results regarding students' abilities to speak and understand spoken Spanish.

Table 1
Participant background and language experience

	Age	Sex	Hometown	Experience studying Spanish	Experience in Spanish-speaking countries	Other	Versant score
Novice-mid/high							
Laura	26	F	Baltimore, MD	HS; 2-3 yrs. PS	None	Did not retain language learned from college classes due to lack of practice outside of classroom	21
Ethan	25	M	Harrisburg, PA	MS, HS; 2-3 yrs. PS	Spain: 7d; Ecuador: 18d*	-	24
Tim	25	M	Walpole, MA	HS; ≤ 1 yr. PS	Ecuador: 21d*	-	29
Intermediate-low							
Nicole	22	F	Canfield, OH	ES; ≤ 1 yr. PS	Dom. Rep.: 10d; Ecuador: 10d	-	37
Cherise	22	F	El Paso, TX	MS, HS; ≤ 1 yr. PS	None	Grew up near U.S.-Mexico border; Spanish-speaking boyfriend	39
Jack	22	M	Buffalo, NY	ES; 2-3 yrs. PS	Spain: 4m	Has learned most of his Spanish through a study abroad/homestay in Spain	41
Intermediate-mid							
Grace	22	F	Upper Darby, PA	HS; ≥ 3 yrs. PS	Ecuador: 10d	Worked in outreach to Hispanic communities in Philadelphia	49
Rachel	22	F	Los Angeles, CA	MS, HS	Mexico: 10d; Costa Rica: 7d; Spain: 5d	-	46
Katie	22	F	Arlington, VA	ES, MS, HS; ≥ 4 yrs. PS	Honduras: 3w; Spain: 4m	-	46
Daniel	22	M	Iowa City, IA	HS; ≥ 4 yrs. PS	Spain: 1m; Guatemala: 10d	-	49
Sarah	25	F	Cleveland, OH	ES, MS, HS; ≥ 4 yrs. PS	El Salvador: 16d; Ecuador: 8d; Spain: 6w; Peru: 10d	Has close friends who come to work in the U.S. each year from Mexico	50
Heritage language learners							
Bianca	22	F	Los Angeles, CA	HS; ≤ 1 yr. PS	Mexico: 21d*; El Salvador: 6d	Heritage speaker; adoptive family speaks some Spanish at home; grandmother who only spoke Spanish lived with family for ~10 years	58
Amalia	22	F	Manhattan, NY	HS; ≤ 1 yr. PS	Spain: 5m	Heritage speaker; mother (Colombian) spoke to her only in Spanish at home; also studied abroad in Spain	68
Gustavo	23	M	Quito, Ecuador Sacramento, CA	ES, MS, HS; ≤ 1 yr. PS	Ecuador: 9y; El Salvador: 4.5m; Dom. Rep.: 10d; Mexico: 10d; Nicaragua: 10d; Guatemala: 20d	Heritage speaker, born and raised in Quito, Ecuador for first 9 years; immigrated to California but spent summers in Ecuador; mother is a NS of English	70

Note. *non-consecutive. ES=Elementary school; MS=middle school; HS=high school; PS=post-secondary.

3.3. Instrument

The perception task analyzed how coda-aspirated variants in four phonological positions (V/s/C, V/s/#C, V/s/#V, and V/s/##) were perceived and associated with different Spanish phonemes. Following and expanding upon the work of Schmidt (2011), a NS of an aspirating variety of Spanish (Cuban)[5] was recorded producing aspirated /s/ in 56 nonce word pairs embedded in a carrier phrase (as well as 36 distractor pairs) in order to simulate aspiration occurring in natural speech. Nonce words were chosen in place of real words to eliminate the possibility for participants to use their lexical knowledge to determine the status of /s/ and to avoid potential frequency effects. As Schmidt (2011, p. 177) points out, "Only through measures of perception in which listeners must rely solely on information in the speech signal (e.g., through the use of nonce words) can the perceptual linguistic system of the listener be accessed". The nonce word carriers for the target stimuli (aspirated variants of coda /s/) were created based on the phonotactic patterns of word-internal coda sibilants in Spanish. Like Schmidt (2011), the initial consonant of the target stimuli could be any legal Spanish word-initial single consonant: voiced stop, voiceless stop, liquid, nasal, affricate, or fricative; however, initial /x/ was avoided in order to remove the possibility of syllables with two post-palatal fricatives. File-Muriel (2007) found that in word-internal /sC/ sequences, coda /s/ is most frequently followed by a voiceless stop in Spanish. In order to reflect this pattern, for the two /s/C sequences – word-internal and word-final preconsonantal – only voiceless stops were included as possible consonants among the target stimuli. All nonce words were disyllabic or trisyllabic, composed of either CV or CVC syllables, and carried stress on the penultimate in order to control for stress.

Each case of aspiration recorded by the NS was confirmed audibly and visually on Praat (Boersma & Weenick, 2017) by the absence of high frequency frication on the spectrogram and aperiodicity in the wave form. After recording, the nonce word pairs were extracted from the carrier phrase to eliminate phrasal level intonational patterns and randomized alongside the distractor pairs (see Table 2 for a list of target stimuli).

Table 2
Target stimuli for perception task by following phonological context

V/s/C	V/s/#C	V/s/#V	V/s/##
baspe mergo	defos cato	nedos olmeda	leste dicas
gasco plache	mincos pacho	catus artoso	bispa fepas
lespo dacas	pales queba	fincos ibidas	dasca delos
lisco lepa	nemos paluna	bonas estano	desto catis
mesque demo	bames pele	noros utino	fespe chercos
nista cata	mebas teno	fapus anoda	nosca poles
sosca nergo	fapes tinco	peles egana	despa docas
disto pame	bafos pile	nechos higulo	fiste tepos
nasta deca	nelos tabilo	bafos homulo	gaspo deros
bisca mepa	fapis quinsulo	piles ulana	mispo catos
pispe deno	boles terbo	febas alcana	nisque fergos
tosque cate	pules cudulos	tebos upicha	gosco nepos
cospa lergo	neros carpa	nelos efarno	pisque ducas
desca pafo	fincos porona	rincos iluso	chesto ponas

To complete the perception task, participants listened to the series of nonce word pairs via a sound file played through an Apple iPhone with a head set. Each nonce word pair was played twice. Because /s/ appears in the first word of the pair for the V/s/C, V/s/#C, and V/s/#V contexts, but in the second word for the V/s/## contexts, sections 1-3 of the task asked participants to identify the first word while section 4 ask them to identify the second. Participants selected the nonce word that they heard from the following options:

[5] The researcher first recorded two different NSs of coastal Ecuadorian Spanish producing the target stimuli with the intention of matching the dialect of stimuli to the input dialect of the participants. However, producing nonce words with intentional aspiration was extremely difficult for these NSs and many words were produced with irregularities, both in the /s/ segment and in others. This may have been a result of /s/-weakening not being as widespread in coastal Ecuador as in other regions of the Spanish-speaking world as well as the variable being below the consciousness of many NSs of this variety (Escalante, 2016). Due to the irregularities, the stimuli were not considered to be reliable and therefore an educated speaker of a Cuban dialect, who was familiar with intentionally controlling /s/ through aspiration and maintenance, was asked to produce the stimuli. After careful examination of the spectrograms of NSs of coastal Ecuadorian Spanish and of the stimuli produced by the Cuban speaker, it is the opinion of the researcher that the process of aspiration is similar in temporal and spectral terms.

(1) coda 's'; (2) no coda 's'; (3) coda 's' plus an interchanging of two phonetically and perceptually similar sounds, represented by their graphemes p-b, t-d, c/qu-g, r-l, m-n, word-initial s-f; and (4) no coda 's' plus an interchanging of two phonetically and perceptually similar sounds, represented by their graphemes p-b, t-d, c/qu-g, r-l, m-n, word-initial s-f. A fifth option, *unsure*, was also provided. For example, for stimulus *baspe*, listeners heard [báh.pe] and choose between *baspe*, *bape*, *paspe*, *pape*, and *unsure*. The perception task was administered for the first time one week prior to departure (interval 0) and then at five intervals in-country, each 8-10 weeks apart. This interval schedule was chosen in order to pinpoint if there was a certain window during the year of immersion where the greatest gains in perception were more likely to be seen, or if the process was more linear in nature, with participants showing improvement over time.

3.4. Coding and analysis

Because the goal of the study was to measure how participants perceived coda /s/ and not necessarily how they perceived other consonants, perception of /s/ was coded as a binary variable: perceived or not perceived. If a participant chose the option with coda 's' (*baspe*) or 's' with one incorrect sound (*paspe*), it was coded as perceived. If the participant chose one of the other three options (*bape*, *pape*, or *unsure*), the token was coded as not perceived. The dependent variables were then coded for the factors seen in Table 3.

Table 3
Factor group and factors

Following phonological context
Word-internal preconsonantal
Word-final preconsonantal
Word-final prevocalic
Phrase final
Exposure[6]
Pre-arrival
Post-arrival
Proficiency
Novice-mid/high
Intermediate-low
Intermediate-mid
HLL
Individual (random)
Participants 1-14

A total of 4,381 tokens were collected from the perception task which were then submitted for multivariate analysis using Rbrul (Johnson, 2009), a specialized application of logistic regression for sociolinguistic research that runs on R (R Core Team, 2013) and that allows the researcher to include continuous predictors such as exposure time and random effects such as individual[7]. Rbrul results can be interpreted in a similar fashion to data of Goldvarb (Sankoff, Tagliamonte, & Smith, 2012). A centered factor weight between 0.0 and 0.5 indicates that the factor disfavors use of the variant that has been selected as the application value, with weights closer to 0 indicating a stronger disfavoring effect; a centered factor weight between 0.5 and 1.0 indicates that the factor favors use of the variant selected as the application value, with weights closer to 1 indicating a stronger favoring effect. Rbrul also provides log odds, the natural logarithm for the odds of each factor, percentages, and numbers of tokens for each individual favor. The analysis provides significance levels of each individual factor group through a step-up, step-down procedure, excluding from the model those factor groups that fail to reach significance (Bayley & Holland, 2014, p. 394).

[6] Exposure was first run as a continuous factor, then as a fixed factor, then as a binary variable in an attempt to find the statistical model with the strongest explanatory effect. This is explained in more depth in the results section.
[7] For further information regarding logistic regression analyses for sociolinguistic research, see Bayley (2013).

4. Results

The goal of the multivariate analysis was to assess the linguistic and extralinguistic factors influencing participants' ability to consider [h] a legitimate variant of /s/. Of the four factors examined (phonological context, interval in-country, individual [random variable], and proficiency level), all factors were determined to be significant predictors except for proficiency level. In a secondary analysis that removed HLLs, proficiency level was deemed a significant factor group. The results are provided in Table 4.

Table 4
Positive identification of /s/-weakening by factor group

	N tokens	% identified as [s]	Log odds	Centered factor weight
Phonological context				
/s/C	1153	0.629	1.526	0.821
/s/#C	1153	0.382	0.247	0.561
/s/##	999	0.270	-0.376	0.407
/s/#V	1076	0.135	-1.396	0.198
Exposure				
Pre-arrival	735	0.178	-0.753	0.32
Post-arrival	3646	0.398	0.753	0.68
Participant				
Gustavo (HLL-Ecua)	321	0.695	1.694	0.866
Sarah (L2 int-high)	319	0.596	1.286	0.789
Daniel (L2 int-high)	318	0.503	0.853	0.699
Grace (L2 int-high)	320	0.466	0.592	0.654
Rachel (L2 int-high)	317	0.457	0.514	0.648
Katie (L2 int-high)	313	0.351	0.053	0.513
Nicole (L2 int-low)	315	0.349	0.051	0.511
Ethan (L2 nov.)	316	0.329	-0.029	0.479
Jack (L2 int-low)	317	0.297	-0.373	0.431
Laura (L2 nov.)	263	0.274	-0.39	0.409
Cherise (L2 int-low)	316	0.266	-0.403	0.386
Amalia (HLL-Col)	317	0.192	-0.774	0.275
Bianca (HLL-Mex)	314	0.175	-1.056	0.250
Tim (L2 nov.)	315	0.076	-1.957	0.109
Proficiency*				
L2 Novice	894	0.224	n/s	n/s
L2 Intermediate-low	948	0.304	n/s	n/s
L2 Intermediate-high	1587	0.475	n/s	n/s
Heritage	952	0.356	n/s	n/s

Note. Centered input probability: 0.2. Log likelihood: -2157.196. Phonological context: p=3.49e-170. Exposure: p=7.13e-43. Participant: random, not tested. Proficiency: p>0.05. *Factor group insignificant at 0.05 level.

4.1. Phonological context

Results suggest that phonological context plays an important role in the ability to map [h] to /s/. Participants identified aspiration as /s/ most readily when it was followed by a consonant; within the two preconsonantal contexts, [h] was most often mapped to /s/ when it appeared in word-internal position (69.2%) as compared to word-final (38.2%). Participants were less successful at perceiving an aspirated /s/ when it appeared in phrase-final position (27%) or word-final prevocalic position (13.5%). The centered factor weights of the statistical analysis mirror these findings, with the two preconsonantal contexts favoring positive identification of /s/ (0.821 for word-internal and 0.561 for word-final), prepausal /s/ slightly disfavoring identification (0.407), and prevocalic contexts strongly disfavoring it (0.198).

Not only was it easier for participants to perceive /s/ in the two preconsonantal contexts, but it was also where the most growth occurred between pre- and post-arrival rates (see Table 5). Pre-arrival, participants were relatively poor at perceiving /s/ across all phonological contexts, with perception rates clustered more closely to the mean (SD=9.798). However, over time there was significantly greater

improvement in the two preconsonantal contexts as compared to the prevocalic and prepausal contexts, creating wider differences between the four factors (*SD*=23.757).

Table 5
Perception rates by phonological context pre- and post-arrival

Phonological context	Pre-arrival perception rate	Post-arrival perception rate	Increase
/s/C	23.8%	70.7%	46.9%
/s/#C	20.2%	41.9%	21.7%
/s/##	23.8%	27.7%	3.9%
/s/#V	3.3%	15.5%	12.2%

Similar patterns emerge when examining cross-tabulations of individual performance over time for each phonological context (see Figures 2-5). As seen in Figure 2, for the /s/C context, there are large gaps between the pre- and post-arrival lines, indicating the greatest improvement in word-internal position, albeit not among all individuals. For the two outliers, Gustavo and Tim—the highest and lowest performers—there was almost no improvement between pre- and post-arrival. Figure 3 indicates that for the /s/#C context, there is also significant improvement for most participants, though less so than for the word-internal context and excluding the three lowest-performing individuals (Tim, Bianca, and Amalia) and the highest-performing individual (Gustavo). As seen in Figure 4, for the third context, prepausal /s/, there is largely static performance between pre- and post-arrival for all individuals except for the highest-performing individual (Gustavo). This indicates that exposure to /s/-weakening dialects does not necessarily lead to increased comprehension in all phonological contexts. Lastly, Figure 5 illustrates that the prevocalic context was the most difficult context in which to perceive aspirated /s/ pre-arrival, but that there was some improvement after exposure. This improvement, however, was visible mainly among the top half of the perceivers.

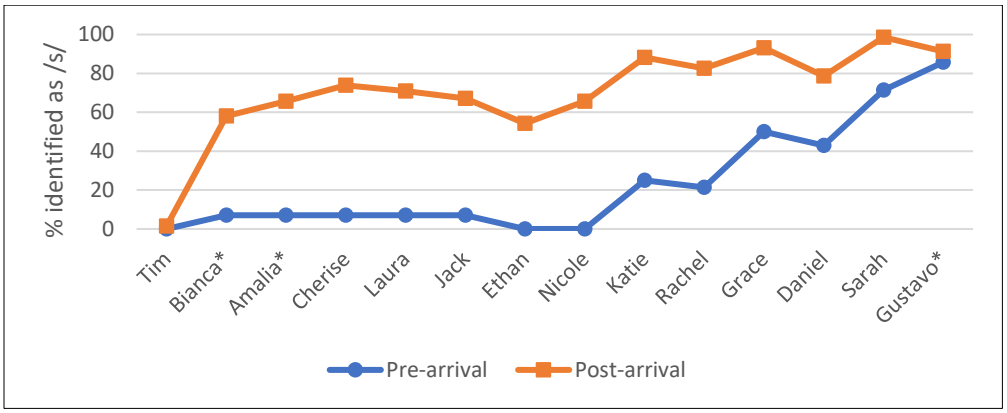

Figure 2. Percentage of positive identification of weakened /s/ by participant: /s/C context (*=HLL)

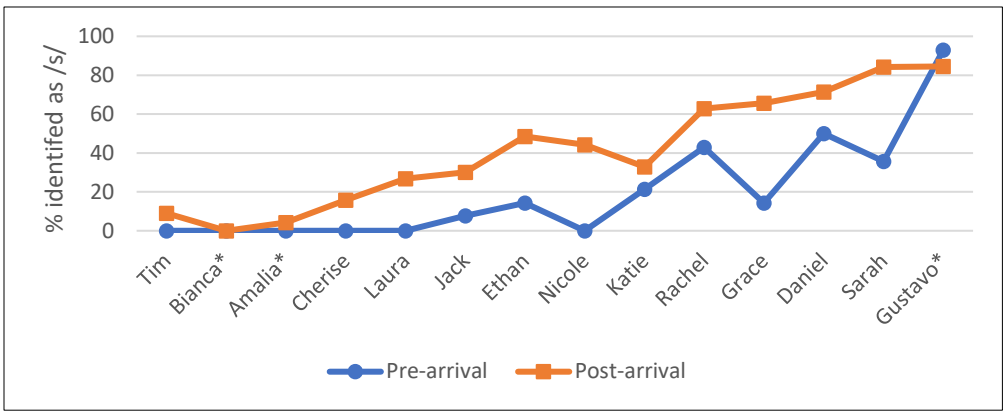

Figure 3. Percentage of positive identification of weakened /s/ by participant: /s/#C context (*=HLL)

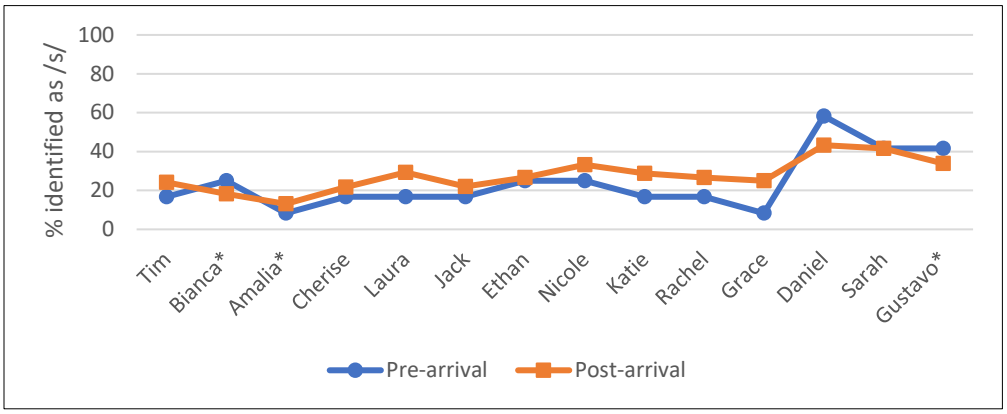

Figure 4. Percentage of positive identification of weakened /s/ by participant: /s/## context (*=HLL)

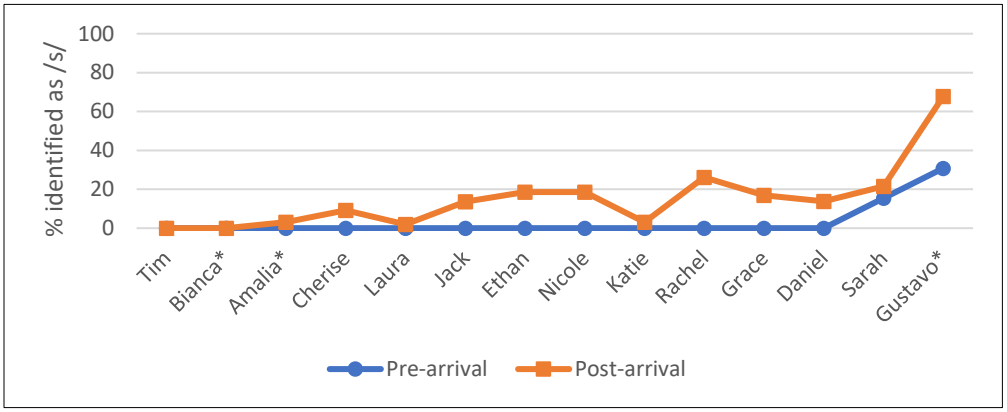

Figure 5. Percentage of positive identification of weakened /s/ by participant: /s/#V context (*=HLL)

4.2. Exposure

In general, participants made significant gains in their ability to perceive weakened forms of /s/ after exposure to the variable in Ecuador. Before arriving (interval 0), they were able to successfully map [h] to /s/ at a rate of 17.8% but by the first interval (roughly two months into their stay), their rate had increased to 39.6%. Although it was hypothesized that participants would continue to make gains in their ability to perceive weakened /s/, after interval 1, perception largely leveled off. At interval 2, there was a slight increase to 40.6%, but after that, each successive interval witnessed fairly steady perception rates, concluding at 38.9% at the final interval. Between intervals 1 to 5, the overall rate of perception did not change more than 1.7% (see Table 6).

Table 6
Perception of /s/-weakening by interval in-country

	Interval in-country					
	0	1	2	3	4	5
Percentage identified	17.8	39.6	40.6	39.4	40.4	38.9
As continuous factor (Log odds)			+1 0.096			
As fixed effect (Centered factor weight)	0.222	0.552	0.573	0.560	0.575	0.553
Binary variable (Centered factor weight)	0.32			0.68		

Note: As fixed effect: Log likelihood= -2156.724. As binary variable: Log likelihood= -2157.196.

Because it was hypothesized that participants would continue to improve in their ability to perceive and process /s/-weakening over time, the statistical analysis considered time in-country first as a continuous variable. However, the results of this analysis (+1 log odds=0.096) did not adequately reflect that there was not in fact a constant shift over time but rather one main jump followed by relative stability. To improve upon the model, next an analysis was run considering interval in-country as a fixed effect, with each interval representing a factor within the group. Although this analysis was an improvement over the continuous one – with centered factor weights illustrating that interval 0 disfavors identification of /s/ whereas each of the remaining intervals are largely neutral with a slight preference toward positive identification – there was no evidence to suggest that perception varied enough between intervals 1-5 to necessitate a separation of those factors. As such, it was decided that in order to improve the model further, time in-country would be considered a binary variable: pre-arrival and post-arrival. This analysis was statistically as reliable as the fixed factor analysis[8], had fewer degrees of freedom (*df*=3), and more accurately represented the data, illustrating through the centered factor weights that pre-arrival disfavored identification of [h] as /s/ (0.32) whereas post-arrival favored it (0.68).

4.3. Individual

In addition to following phonological context and time in-country, individual as a random effect was also a significant predictor of the ability to accurately perceive /s/-weakening. Perception varied considerably between the individuals who most- and least- accurately identified /s/, with the strongest individual perceiving aspiration at a rate of 69.5% and the weakest at 7.6% (see Figure 6). Centered factor weights ranged from 0.866 to 0.109, with the median weight nearly neutral at 0.495. Data regarding years of Spanish study and naturalistic exposure to the language through travel and contact with NSs is included in the report of individual performance.

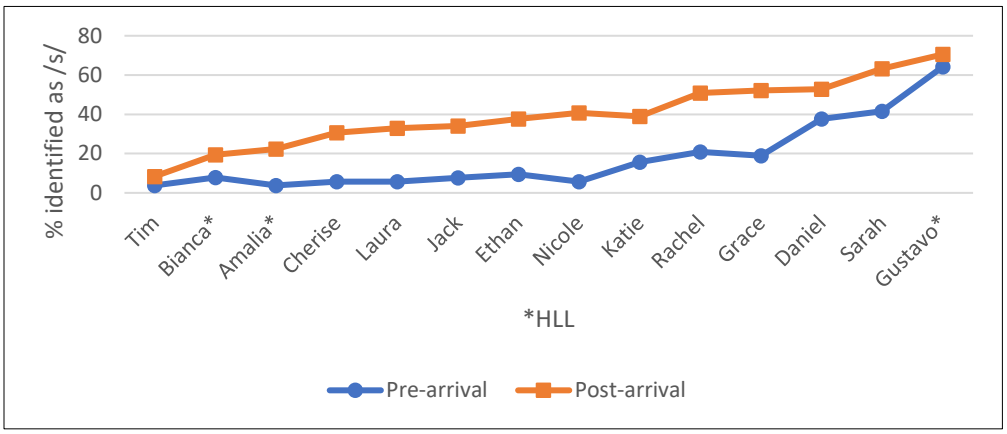

Figure 6. Percentage of positive identification of weakened /s/ by individual: pre- and post-arrival

Seven participants had positive centered factor weights, meaning that they were more likely to identify aspirated variants as /s/ (see Table 1 for details regarding participant background information). Gustavo, the HLL of highland Ecuadorian descent (largely an /s/-conserving region), was the individual with the greatest overall rate of identification of /s/ (centered factor weight=0.866) as well as the individual with the highest Versant Oral Proficiency Score (70) of the participant pool. Gustavo grew up in Quito, Ecuador for the majority of his childhood and at age 9 moved to Sacramento, CA with his mother where he was mostly exposed to Mexican Spanish. In addition to learning Spanish in a naturalistic environment as a child in Ecuador, Gustavo also studied the language once he moved to Sacramento in elementary, middle, and high school as well as one year in college and had exposure to both /s/-weakening and /s/-maintaining dialects

[8] As explained in Bayley (2013), goodness of fit is measured by comparing the log likelihoods of the models, with those closer to zero being better fits than those further from zero. In this case, the difference in log likelihoods was 0.472 which is not statistically significant, suggesting that the binary model is as reliable as the fixed-factor model but with greater explanatory power because it more accurately reflects that there was only one main change in perception scores.

through immersion trips to El Salvador, the Dominican Republic, Nicaragua, Mexico, and Guatemala. After Gustavo, the next five individuals with the highest perception rates (Sarah, Daniel, Grace, Rachel, and Katie), which ranged from 59.6% to 35.1%, were also the top five most proficient L2 speakers according to their Versant scores. All of these intermediate-mid individuals had studied Spanish for three to four years in high school and for four years in college (except for Rachel) prior to the volunteer experience and had spent significant time with NSs of Spanish prior to arrival, either through immersion programs, civic engagement projects in Latino communities in the United States, and/or friendships with local NSs of Spanish. The last individual to have a slightly positive centered factor weight (0.511) was Nicole with a rate of positive identification of aspiration of 34.9%.

The remaining seven individuals had centered factor weights between 0 and 0.5, meaning that they favored identification of [h] as Ø. Their rates of perception ranged from 32.9% to 7.6%. With the exception of the two heritage speakers (Amalia and Bianca), these individuals had fewer years of Spanish instruction, lower proficiency levels, somewhat less experience abroad, and reported less contact with NSs than the seven most accurate perceivers. The seven lower-performers reported between one to three years of Spanish instruction at the undergraduate level but experience abroad varied significantly; Cherise and Laura reported none at all, Bianca, Ethan, and Tim participated in short-term immersion experiences to /s/-weakening regions, Jack and Amalia spent one semester abroad in Spain, and Amalia and Bianca spent time as children visiting family members in Colombia and Mexico, respectively, in addition to speaking Spanish at home.

4.4. Proficiency

When the entire participant pool was included in the analysis, the factor group of proficiency level was not found to be a significant predictor of positive identification of /s/. However, after analyzing results at the individual level, it was clear that the three HLLs did not exhibit similar patterns of perception; on one hand, Gustavo perceived aspiration at the highest rate (69.5%) of all participants while Amalia and Bianca perceived only 19.2 and 17.5% of forms, respectively, the second- and third-lowest rates of the entire group. Due to this lack of intra-group cohesion, a secondary analysis was run with the three HLLs removed. In this analysis of only L2 speakers, proficiency level was found to be a significant predictor, with intermediate-high speakers favoring higher levels of accuracy (centered factor weight=0.697), intermediate-low speakers nearly neutral with a slight favoring of inaccuracy (0.427), and novice speakers favoring inaccuracy (0.327). The results are presented in Table 7.

Table 7
Rates of perception of /s/-weakening by proficiency level (L2 speakers only)

Proficiency	N tokens	% identified as [s]	Log odds	Centered factor weight
Intermediate-high	1587	0.475	0.833	0.697
Intermediate-low	948	0.304	-0.110	0.472
Novice	894	0.224	-0.723	0.327

Note: *p*=0.00768. Centered input probability: 0.17. Log likelihood: -1727.426.

Taking into account proficiency level and time in-country, we see that the novice and intermediate-low groups arrived with similarly weak abilities to perceive coda aspiration, whereas the intermediate-high group arrived with significantly higher scores. Over time, the intermediate-low group made the largest strides in perception of /s/ (improving their scores by 28%), followed by the intermediate-high group (24.6%) and lastly by the novice group (19.5%). These results are presented in Table 8.

Table 8
Rates of perception of /s/-weakening by time in-country and proficiency level (L2s only)

Proficiency	Pre-arrival rate (%)	Post-arrival rate (%)	Improvement (%)
Intermediate-high	27	51.6	24.6
Intermediate-low	6.4	35.1	28.7
Novice	6.3	25.8	19.5

5. Discussion

Results of the multivariate analysis suggest that leaners' ability to map aspirated variants to /s/ varies according to phonological context of the /s/ in question, learner exposure to the variable, individual learner differences, and for L2 speakers, proficiency level. Each of these factors are discussed in the following sections.

5.1. Phonological context

The results of the statistical analysis suggest that aspiration in preconsonantal contexts is easier to perceive than in prevocalic or prepausal contexts. Additionally, there was greater improvement over time in the two preconsonantal contexts than in the prevocalic or prepausal contexts, suggesting that increased exposure does not lead to improvement in the ability to perceive aspiration in all phonological contexts equally. These results are congruent to previous research (Figueroa, 2000; Hammond; 1978) which has also suggested that /s/-weakening is easier to perceive in preconsonantal contexts, and very difficult to perceive even for NSs when presented in isolated words with little to no contextual clues.

The relative difficulty that listeners face in perceiving weakened /s/ in prevocalic or prepausal positions as compared to preconsonantal may be attributed to a variety of factors. First, it may be a result of residing in a more open acoustic space. Whereas a following consonant creates an occlusion behind the weakened /s/—leaving a space-holder of sorts which signals to the listener that there is something that belongs there—when /s/ is followed by a pause or vowel, the weakened sound experiences gestural overlap with the following open vocalic space (in the case of vowels) or the following silence (in the case of pauses). These more open acoustic spaces may make it more difficult for the listener to perceive when weakened forms begin and end. Secondly, listeners may pick up on enhanced acoustic cues available in the word-internal context due to increased syllable duration. Because the stimuli set was designed to replicate the most common /s/-patterns in Spanish, word-internal preconsonantal [h] always occurs in the coda of a stressed syllable, while word-final [h] always occurs in the coda of an unstressed syllable. Because stress tends to lengthen Spanish syllables and the segments they contain (Ortega-Llebaria & Prieto, 2007), listeners may be able to perceive the aspirated stimuli in stressed syllables better due to the longer cues to glottal frication that they hear as compared to those in the shorter, unstressed syllables. Finally, it is possible that other cues might have aided listeners in perceiving preconsonantal [h] that are not possible in prepausal or prevocalic contexts, such as compensatory lengthening of the following onset consonant (Hayes, 1989) or longer VOT for voiceless stops—a phenomenon seen in Andalusian Spanish (Gerfen, 2002; Parrell, 2011; Torreira, 2006; 2007, 2012). In that variety of Spanish, which is characterized by widespread /s/-weakening, the compensatory lengthening of the dental stop combines with a change in the glottal gesture with respect to stop contact. This timing change increases the VOT of the stop, producing a moment of voiceless post-aspiration in the acoustic signal (Bradley, 2014, p. 346). Although no evidence of such post-aspiration was found in the stimuli, listeners may still display sensitivities to compensatory lengthening or VOT changes in following consonants that are simply not possible in prevocalic or prepausal contexts.

5.2. Exposure

Exposure was found to significantly constrain the variable, with pre-arrival scores unsurprisingly lower than post-arrival scores; however, the learners' ability to consider [h] as a legitimate variant of /s/ did not progress in a linear fashion throughout their year in-country. Instead, growth was clustered between intervals 0-1 and then remained relatively static for the remainder of the year. Of the few studies that have investigated the perception of weakened /s/ among language learners, most are cross-sectional in nature (George, 2014; Schmidt, 2011), which eliminates the possibility to measure individual gains over time. However, the two studies that have explored /s/-weakening perception longitudinally (Rasmussen & Zampini, 2010; Schmidt, 2009) considered only two time points: pre-arrival and post-departure of short-term study abroad programs (6 weeks and 3 weeks, respectively). Although they both found that time spent abroad in an /s/-weakening region facilitated an increased ability to perceive the variable, their methodology did not allow for the tracking of /s/ perception during participants' time in-country. As such, it is unclear if they would have found similar patterns of initial gains followed by stability.

One possible reason as to why participants in the current study made the greatest gains during the first 8-10 weeks but then remained relatively static throughout the rest of the year may be attributed to general tendencies in perceptual learning. In particular, research has suggested that "the bulk of perceptual

learning may actually take place fairly early in late-onset SLA" (Best & Tyler, 2007, p. 21). But just how early is "fairly early"? According to Flege & Liu (2001) and Jia, Strange, Wu, Collado, & Guan (2006), significant L2 perceptual learning has been observed in late learners after as little as 6-12 months of immersion in the TL, as compared to those with 0-6 months of experience, but that very little perceptual benefit seems to accrue from additional experience past that initial period for most late learners. Additionally, no significant differences have been found between SLA adults with 6-12 moths of experience and those with 1.5 years or more (Aoyama, Flege, Guion, Akahane-Yamada, & Yamada, 2004; Jia et al., 2006; Tsukada et al., 2005). These findings in some ways support the results seen in the current study, as they suggest that gains in perception are seen relatively early in SLA learning. However, in the current study, the bulk of improvement is witnessed well before the 6-month mark, whereas in previous studies, the perceptual benefit was greatest between months 6-12. Best and Tyler (2007, p. 32) explain that when assessing changes in speech perception over learner development, "the passage of time is likely serving as a surrogate for the real underlying sources of influence": the listener's development in recognizing the structural and phonetic properties of their L1 and L2, along with "other individual and environmental factors that co-vary with their language development". As such, further research on L2 perception in general and the perception of /s/-weakening in particular is needed to better understand what those individual and environmental factors may be that are influencing the processes of phonological re-mapping of /s/ categories.

5.3. Individual

To summarize the tendencies of the individuals with the highest perception scores, common among these top six /s/-perceivers were high proficiency ratings and reported interaction with NSs of the TL for an extended period of time prior to the volunteer year either through living abroad, study abroad, or contact with immigrant communities. For all of the top six perceivers except for Rachel, additional commonalities were more than two years of Spanish instruction at the undergraduate level and experiences of two weeks or more with /s/-weakening dialects of Spanish prior to the volunteer year either through naturalistic exposure, study abroad, and/or immersion experiences. Lower-scoring individuals tended to have lower proficiency levels, less exposure to Spanish through instruction, and less intense contact with NSs with the exception of the two female HLLs. As such, the results of this factor group align in some ways with those of previous studies (Rasmussen & Zampini, 2010; Schmidt, 2011; Trimble, 2011), which have suggested that the ability to perceive weakened /s/ are generally marked by language proficiency and study abroad participation and/or contact in the TL outside of class, especially in /s/-weakening regions.

The results of the lower-scoring individuals, however, are problematic for the conclusions reached in previous studies. Most important is that in previous studies, exposure to /s/-weakening dialects was linked to the ability to map [h] to /s/, whereas in this study, exposure to the variable was not enough to guarantee such mapping. Although it is true that the pre-arrival perception scores were higher for those with more extensive previous contact with NSs[9], once in Ecuador, the playing field was leveled; all participants, no matter their previous language experience, were exposed to /s/-weakening on a daily basis via interaction with locals at job sites, conversations with neighbors/community members, and the completion of everyday tasks such as buying groceries and navigating local transportation systems. Despite this exposure, several individuals hardly improved at all over time (Tim, Bianca, Amalia), suggesting that exposure alone is not sufficient to acquire the ability to perceive /s/-weakening. Additionally, the results do not align in terms of increased proficiency favoring improved perception; the two female HLLs, Amalia and Bianca, had the second- and third- highest proficiency scores of the participant pool but had the second- and third- lowest rates of perception.

[9] An important exception to this was Jack, who spent one semester in Sevilla, Spain. This individual was ninth out of 14 in perception scores, even though he had spent the most time in an /s/-weakening region (pre-arrival) of any volunteer except for Gustavo. Although this individual expressed having a close relationship with his host family who communicated with him entirely in Spanish, the experience did not translate into the ability to perceive weakened forms of /s/ without any contextual clues, as evidenced by the pre-arrival results. It also did not seem to allow him to improve at a rate significantly greater than his peers. Schmidt (2011) found similar results among her participants whose exposure to /s/-weakening dialects came from Western Andalusia; she found that only four of the individuals who had experience abroad solely in /s/-weakening regions were not successful in identifying aspiration as /s/, but of those four, three had study abroad in Andalusia. Because that region is characterized by a different realization of weakened-/s/, a longer voice onset time (postaspiration) of the following voiceless obstruent, as in [mó.k^{h}a] (Torreira 2006), she suggests that exposure to any form of syllable-final /s/- weakening may not transfer to the association of all other weakened variants with /s/, at least for some learners.

Based on these results, I argue that exposure to NSs of Spanish and to /s/-weakening varieties in particular is still an influencing factor in the ability to accurately perceive the variable, however, that a minimum proficiency level is required for exposure to have an effect. I also suggest that for HLLs, long-time exposure to /s/-conserving dialects may block the ability to perceive /s/-weakening more so than for L2s. It is unclear at this time why that may be the case, especially considering that most research has shown that HLLs tend to have a phonological advantage over L2s in production of the HL (Chang, Yao, Haynes, & Rhodes, 2011) and that even when HLLs do not produce certain contrasts in the same way as NSs, they do perceive it in the same way (see Kim, 2012). It is possible that this phonological advantage may not extend to include a perceptual advantage in all cases, especially when new categories in new contexts must be created, meaning that the L2 interlanguage perceptual system may potentially be more malleable than that of HLLs. However, there has been very little research on the sound system of HLLs in general and even less on how HLLs learn to re-map variable categories. As such, the results of this study support the call for future research in the area of perception of variable forms among HLLs.

5.4. Proficiency

Taking into consideration only the L2 speakers, the results of the proficiency factor group echo the findings of previous studies which have shown that greater language proficiency generally tends to translate into higher rates of /s/ perception. For example, in her study of L2 speakers at five different proficiency levels, Schmidt (2011) found that perception of syllable-final [h] as /s/ did not emerge until level 3 and increased at each subsequent level. However, as Schmidt (2011) points out, "it should be stressed that increased identification of coda [h] as 's' is not due to greater proficiency in a second language per se, but rather may reflect several different factors that correlate with higher proficiency level (greater exposure)" (p. 154). As she explains, several factors are typically confounded with proficiency level. For example, in her study, higher proficiency speakers usually reported explicit linguistic knowledge and/or experiences in /s/-weakening regions, while most lower level learners had not been abroad at all and had no linguistics training. She carefully states that although her data point to higher proficiency levels favoring more accurate identification of aspiration, it in no way seeks to claim that increased *proficiency* is the driving factor in acquisition of the dialectal variants, but rather that increased proficiency generally represents increased language exposure and linguistic knowledge (p. 154).

She then asks a very important question: why do lower proficiency L2 speakers tend to be less accurate than their more proficient counterparts—consistently mapping [h] to Ø? She suggests that these learners may be relying on patterns from the phonological system already in place—their first language, English—which does not allow syllable-final /s/-weakening in standard dialects. Thus, in English, any syllable-final [h] is simply noise in the signal; it is not a legitimate variant of /s/ and does not cue contrastive information. For example, L1 English speakers would not /duht/ to mean /dust/ (George, 2014, p. 98) and syllable-final aspiration in a word such as *table* [teIh.bəl] would not provide new meaning as compared to [teI.bəl] (Schmidt, 2011, p. 149). She states that novice and intermediate-low speakers may not have had sufficient (or any) input of these weakened forms to develop the new phonological patterns of the second language that would naturally occur with greater exposure to varieties outside of the classroom. Additionally, she explains that even if L2 learners are exposed to instructors of /s/-weakening dialects inside the classroom, research has shown that these speakers may adjust their speech in the classroom toward a more /s/-conserving style (Santilli, 1996) or may produce different forms of /s/-weakening other than aspiration which was the variant targeted in her study.

Although these factors likely play a role in the complicated relationship between proficiency and perception of weakened /s/, they do not have the explanatory power to account for all of the results of the current study. Most important is the fact that Schmidt's (2011) cross-sectional study examined a wide range of students taking undergraduate Spanish courses; naturally, some of these students had experience abroad but many did not. Contrastingly, the current study examines only learners participating in a particular immersion experience in a particular region where the variable is present. Thus, whereas Schmidt is able to suggest that novice speakers largely do not have exposure to /s/-weakening which in turn contributes to their low perception rates, all of the participants of the current study were exposed to the variable for an entire year, but even so, the novice speakers were still successful in mapping [h] to /s/ only about a quarter of the time whereas intermediate-high speakers were successful slightly more than half the time. This seems to suggest that actual proficiency may be more powerful of a predictor than it has been given credit for—that if exposure is held controlled (at least once arriving in the /s/-weakening region), both intermediate-low and

intermediate-high speakers still have an advantage over novices in their overall perception rates and both improve over time at a faster rate than novices.

As such, I suggest that proficiency in and of itself is an important predictor of the perception of /s/-weakening because it is typically representative of greater global comprehension abilities, which, I argue, are necessary for a remapping of the phonological system. In a place such as coastal Ecuador, where /s/-weakening is not categorical, learners are exposed to contrasting information regarding syllable-final /s/. They are receiving input of exemplars where /s/ ranges from fully sibilated to fully deleted. Novice speakers with weaker comprehension abilities may be receiving this input, but if they are unfamiliar with a large percentage of the input they receive (i.e. less of the input is converting to *intake*, meaning that it is not incorporated into the interlanguage system [see Corder, 1967, p. 165]), they have retained fewer exemplars in their system of weakened /s/ and fully-sibilated /s/ mapping to the same underlying form. As such, it is much more difficult to for these speakers to re-map their interlanguage phonological system since they are lacking the linguistic information necessary to make those changes. However, if speakers have greater comprehension abilities, they are able to more easily recognize words and phrases containing /s/, more quickly associate [h] and other weakened forms to /s/, more accurately internalize local patterns of variation, and more efficiently re-map their phonological system.

Lastly, the fact that proficiency was not a significant factor group when the HLLs were included in the analysis underscores the heterogeneity of the HLL population (Potowski, 2013) and may also point to perception abilities being tied more to an HLL's home dialect than to the fact that they are an HLL (as opposed to an L2). Similar to the results of Amalia and Bianca presented here, Schmidt (2014) found that NS of Spanish from /s/-conserving regions had difficulty identifying weakened-/s/; thus the two female HLLs are performing (at least initially) similarly to monolingual Spanish speakers from conserving dialects. The curious piece, however, is that they do not make perceptual changes during the immersion experience (while Schmidt (2015) did find that conserving speakers with contact with weakening speakers did tend to perceive aspirated-/s/ as /s/). Future research should explore further these individual differences among HLLs to investigate how questions of language use and identity (Norton, 2013; Parra, 2016) relate to perception of dialectal variation.

6. Conclusion

The current study contributes to the growing body of literature in variationist studies in SLA by investigating an under-represented topic of sociolinguistic competence: how speakers perceive and process variation in coda /s/-weakening. Due to the widespread nature of coda /s/-weakening and the resulting likelihood that learners will encounter the variable in their interactions with NSs, it is imperative to understand what they do when they receive competing input variants ranging from [s] to Ø. Incorrectly mapping a weakened /s/ to nothing (i.e. if máØ is understood as *ma* 'mom' rather than *más* 'more', or if habla[h] is understood as referring to the third person singular form rather than second person) has the potential to impede comprehension of lexical items and of the important morphological information that /s/ provides in verbs and plurals.

This study explored how language learners perceive and process coda /s/ aspiration in nonce word stimuli before and after exposure to the variable in a naturalistic environment in coastal Ecuador. The goal of the study was two-fold: (1) to determine the effect of factors such as phonological context, exposure, language proficiency, and individual differences on the ability to map [h] to /s/, and (2) to suggest that studies whose aim is to explore the acquisition of sociolinguistic competence should not look solely at learner production of variable forms but also at their perception of such forms. Although learners may never produce certain variants, gains in perception alone can reflect gains in sociolinguistic competence.

To summarize the results of the first goal, phonological context, exposure, language proficiency, and individual differences were found to significantly constrain the ability to perceive aspiration (with the exception of proficiency among HLLs). Participants were more successful in perceiving aspiration and improved more over time when [h] was followed by a consonant than a vowel or pause. This could be attributed to the fact that following consonants provide occlusion which does not allow for as much gestural overlap of the [h] segment as compared to that which exists with following pauses and vowels. Listeners may also be aided by other acoustic cues such as increased syllable duration in the stressed syllables characteristic of the /s/C context, compensatory lengthening of the following onset consonant, or longer VOT for voiceless stops.

Exposure to the variable was a significant predictor, but continued exposure after the first interval in-country did not result in continued improvement. This suggests that for most learners, a remapping of /s/ categories occurs relatively soon after exposure, but after the initial adjustment, there is no evidence of continued tuning. Future research should explore if these results are similar to those of other phonological variables or if exposure affects each variable differently (as Howard [2012] has suggested is the case for French variables).

Proficiency was a significant factor only for L2s, with higher proficiency levels better at considering [h] a legitimate variant of /s/. Intermediate-low speakers made the greatest gains over time, followed by intermediate-high, and lastly by novices. HLLs did not follow these patterns; despite all three speakers having high language proficiency, two of them had the second- and third-lowest scores overall in the perception tasks, meaning that they performed at a similar level to the least proficient L2s. On the other hand, the third HLL (who had more exposure to /s/-weakening dialects prior to the volunteer experience) was the most successful in mapping [h] to /s/ of the entire participant pool. This underscores the heterogeneity of HLLs and suggests that those from different home dialect backgrounds may process dialectal variation in different ways. Future research should explore how the perceptual systems of HLLs operate in terms of perceiving and processing new dialects.

Lastly, there was significant variation seen at the individual level. These results were in some ways supportive of previous research (i.e. Schmidt, 2011) in that in general, individuals with more language experience and exposure to /s/-weakening dialects seemed to score higher on the initial perception task, but several individuals fell outside of these trends. For example, one intermediate-high L2 speaker had never spent time in an /s/-weakening dialect yet was third overall in perception scores. Another intermediate-high L2 speaker only spent 10 days in an /s/-weakening region and no other time abroad and was fourth in perception scores. The two HLLs with low scores had more extensive language experience than the L2s yet still scored below all but one of them; one participant spent four months in /s/-weakening Andalusia (more than any other L2) but was ninth of 14 in perception scores. The individual variation found in this study supports the findings of Howard (2012) who reported significant individual variation in the initial emergence of French sociolinguistic variants among L2s abroad. He explains that, even with the extensive ethnolinguistic information gathered from his learners about their background language-learning history and experience, "it was not possible to identify a specific factor to explain the ease of use of some of the variants by some of our learners as opposed to the other learners" (p. 29). Similarly, the results of this study suggest that although experience and exposure are important factors, they do not have the explanatory power to account for all of the variation present at the individual level. Future research should consider other factors such as motivation and identity.

As for the second goal, the results of this study suggest that learners can make significant progress in the acquisition of sociolinguistic competence by learning to re-map their phonological system. This growth is evident without even considering if they are producing /s/-weakening themselves but could be overlooked if only production is measured. Although most previous research has focused on the production of variable forms, I argue that it is equally important to study the perception of such forms to understand how learners are internalizing previously unfamiliar variables. Further research on how learners perceive and process /s/-weakening, as well as other phonological variables, has the potential to contribute to SLA theory by improving our understanding of how the learners shift their phonological categories to adapt to the variable nature of language.

Although this study has presented innovative research on the perception of dialectal variation, it is not without limitations. First, the low number of participants, especially for the HLL group, restricts the ability to make broad generalizations regarding L2 and HLL perception of dialectal variation. Future studies with wider participant pools, including more HLL speakers, would allow researchers to confirm or reject the findings of this project. Secondly, because the perception task was repeated every 6-8 weeks, it is possible that the participants became familiar with the task and therefore answered similarly over time. Including more distractor items and randomizing the stimuli may help mitigate this effect. Lastly, during the statistical analysis, the nonce word carrier was not included as a random variable. Because of the gradient nature of /s/-weakening and the fact that the stimuli were created by a real speaker and not inserted artificially, it is undeniable that there was some variation in the weakened /s/ variants used in the stimuli. Running the nonce word carrier as a random variable would help to identify if certain stimuli were easier to perceive than others, potentially suggesting that they were less weakened than others. Including the nonce word carrier as a random variable would also shed light on if phonetic context played a role in perception (i.e. if /s/ was more

accurately perceived before /t/ than before /p/) or if there if there was an effect of frequency (i.e. if a certain nonce word was similar to a highly frequent real word for which learners had already made the weakened-/s/ mapping).

References

Abramowicz, Lucasz (2007). Sociolinguistics meets exemplar theory: Frequency and recency effects in (ing). *University of Pennsylvania Working Papers in Linguistics*, *13*(2), 27-37.

Adamson, H. Douglas, & Kovac, Ceil (1981). Variation theory and second language acquisition. In David Sankoff & Henrietta Cedergren (Eds.), *Variation omnibus* (pp. 285-293). Edmonton, Canada: Linguistic Research.

Adamson, H. Douglas, & Regan, Vera M. (1991). The acquisition of community speech norms by Asian immigrants learning English as a second language: A preliminary study. *Studies in Second Language Acquisition*, *13*(1), 1-22.

Aoyama, Katsura, Flege, James E., Guion, Susan G., Akahane-Yamada, Reiko, & Yamada, Tsuneo (2004). Perceived phonetic dissimilarity and L2 speech learning: The case of Japanese /r/ and English /l/ and /r/. *Journal of Phonetics*, *32*, 233-250.

Barrutia, Richard, & Terrell, Tracy (1982). *Fonética y fonología españolas*. New York, New York: John Wiley and Sons.

Bayley, Robert (1996). Competing constraints on variation in the speech of adult Chinese learners of English. In Robert Bayley & Dennis R. Preston (Eds.), *Second language acquisition and linguistic variation* (pp. 97-120). Amsterdam/Philadelphia: John Benjamins.

Bayley, Robert (2013). The quantitative paradigm. In J. K. Chambers & Natalie Schilling (Eds.), *The handbook of language variation and change* (pp. 85-107). Oxford, United Kingdom: Blackwell.

Bayley, Robert (2014). The role of frequency in phonological and morphosyntactic variation. Plenary talk at *New Ways of Analyzing Variation (NWAV) 43*, October 23-26, Chicago, Illinois.

Bayley, Robert, Greer, Kristen, & Holland, Cory (2017). Lexical frequency and morphosyntactic variation: Evidence from U.S. Spanish. *Spanish in Context*, *14*(3), 413-439.

Bayley, Robert & Holland, Cory (2014). Variation in Chicano English: The case of final (z) devoicing. *American Speech*, *89*(4), 385-407.

Bayley, Robert & Tarone, Elaine (2012). Variationist perspectives. In Susan Gass & Alison Mackey (Eds.), *Handbook of second language acquisition* (pp. 41-56). New York, New York: Routledge.

Bedinghaus, Robert (2015). *The effect of exposure to phonological variation on perceptual categorization and lexical access in second language Spanish: The case of /s/-aspiration in Western Andalusian Spanish*. Unpublished doctoral dissertation, Indiana University.

Best, Catherine T., & Tyler, Michael D. (2007). Nonnative and second-language speech perception: Commonalities and complementarities. In Murray J. Munro & Ocke-Schwen Bohn (Eds.), *Second language speech learning: In honor of James Emil Flege* (pp. 13-34). Amsterdam/Philadelphia: John Benjamins.

Boersma, Paul, & Weenick, David (2017). *Praat: doing phonetics by computer* [Computer program]. Version 6.0.23. http://www.praat.org/.

Bradley, Travis G. (2014). Fonología de laboratorio. In Rafael Núñez Cedeño, Sonia Colina, & Travis G. Bradley (Eds.), *Fonología generativa contemporánea de la lengua española (2a edición)* (pp. 319-367). Washington, District of Columbia: Georgetown University Press.

Brown, Earl K. (2008). *A usage-based account of syllable and word-final /s/ reduction in four dialects of Spanish*. Unpublished doctoral dissertation, The University of New Mexico.

Brown, Esther L., & Torres Cacoullos, Rena (2003). Spanish /s/: A different story from beginning (initial) to end (final). In Rafael Núñez- Cedeño, Luis López, & Richard Cameron (Eds.), *A romance perspective in language knowledge and use. Selected papers from the thirty-first Linguistic Symposium of Romance Languages (LSRL)* (pp. 21-38). Amsterdam/Philadelphia: John Benjamins.

Bybee, Joan (2000). Lexicalization of sound change and alternating environments. In Michael Broe & Janet Pierrehumbert (Eds.), *Laboratory phonology V: Language acquisition and the lexicon* (pp. 250-268). Cambridge, United Kingdom: Cambridge University Press.

Bybee, Joan (2002). Word frequency and context of use in the lexical diffusion of phonetically conditioned sound change. *Language Variation and Change*, *14*(3), 261–290.

Bybee, Joan (2007). *Frequency of use and the organization of language*. New York, New York: Oxford University Press US.

Carvalho, Ana Maria (2006). Spanish (s) aspiration as a prestige marker on the Uruguayan-Brazilian border. *Spanish in Context, 3*(1), 85-114.

Cepeda, Gladys (1995). Retention and deletion of word-final /s/ in Valdivian Spanish (Chile). *Hispanic Linguistics*, 6/7, 329–353.

Chang, Charles B.**,** Yao, Yao, Haynes, Erin F., & Rhodes, Russell (2011). Production of phonetic and phonological contrast by heritage speakers of Mandarin. *Journal of the Acoustical Society of America, 129*(6), 3964-3980.

Clayton, Ian D. (2010). *On the natural history of preaspirated stops*. Unpublished doctoral dissertation, The University of North Carolina at Chapel Hill.

Corder, Stephen P. (1967). The significance of learners' errors. *International Review of Applied Linguistics*, *5*(4), 161-170.

Davidson, Dan E., & Lekic, Maria D. (2013). Comparing learning outcomes and target-language utilization in the Russian flagship. *Heritage Language Journal*, *10*(2), 88–114.

Dickerson, Lonna J. (1974). *Internal and external patterning of phonological variability in the speech of Japanese learners of English: Toward a theory of second language acquisition*. Unpublished doctoral dissertation, The University of Illinois, Urbana-Champaign.

Dohotaru, Puica (2004). Variación de -/s/ en la habla de habaneros universitarios: Condicionamiento lingüístico y social. In Sergio Valdés Bernal (Ed.), *Pensamiento lingüístico sobre el Caribe insular hispánico* (pp. 68-110). Santo Domingo, República Dominicana: Academia de Ciencias de la República Dominicana.

Escalante, Chelsea (2016, April). *Tracking a shifting target: A longitudinal exploration of s-weakening among L2 speakers of coastal Ecuadorian Spanish*. Paper presented at the Eighth International Workshop of Spanish Sociolinguistics, San Juan, Puerto Rico.

Ellis, Rod (1987). Interlanguage variability in narrative discourse: Style shifting in the use of past tense. *Studies in Second Language Acquisition, 9*(1), 1-20.

Erker, Daniel (2010). A subsegmental approach to coda /s/ weakening in Dominican Spanish. *International Journal of the Sociology of Language*, *2010*(203), 9-26.

Erker, Daniel, & Otheguy, Ricardo (2016). Contact and coherence: Dialect leveling and structural convergence in NYC Spanish. *Lingua*, *172–173*, 131–146.

Figueroa, Neysa (2000). An acoustic and perceptual study of vowels preceding deleted post-nuclear /s/ in Puerto Rican Spanish. In Héctor Campos, Elena Herburger, Alfonso Morales-Front & Thomas J. Walsh (Eds.), *Hispanic linguistics at the turn of the millennium. Papers from the 3rd Hispanic Linguistic Symposium* (pp. 66-79). Somerville, Massachusetts: Cascadilla Press.

File-Muriel, Richard (2007). *The role of lexical frequency and phonetic context in the weakening of syllable-final lexical /s/ in the Spanish of Barranquilla, Colombia*. Unpublished doctoral dissertation, Indiana University.

File-Muriel, Richard (2009). The role of lexical frequency in the weakening of syllable-final lexical /s/ in the Spanish of Barranquilla, Colombia. *Hispania*, *92*, 348-360.

File-Muriel, Richard, & Brown, Earl (2011). The gradient nature of s-lenition in Caleño Spanish. *Language Variation and Change, 23*(2), 223-243.

Flege, James E., & Liu, Serena (2001). The effect of experience on adults' acquisition of a second language. *Studies in Second Language Acquisition*, *23*(4), 527-552.

Fox, Michelle Anette Minnick (2006). *Usage-based effects in Latin American Spanish syllable-final /s/ lenition*. Unpublished doctoral dissertation, University of Pennsylvania.

George, Angela (2014). Perception of a regional Spanish sound: The case of /s/-weakening. *Southern Conference on Language Teaching Dimension*, 97-110.

Gerfen, Chip (2002). Andalusian codas. *Probus*, *14*(2), 303-333.

Gudmestead, Aarnes (2014). Variationist approaches to second language Spanish. In Kimberly L. Geeslin (Ed.), *The handbook of Spanish second language acquisition* (pp. 80-94). Malden, Massachusetts: John Wiley & Sons.

Hammond, Robert M. (1978). An experimental verification of the phonemic status of open and closed vowels in Caribbean Spanish. In Humberto López Morales (Ed.), *Corrientes actuales en la dialectología del caribe hispánico* (pp. 33-125). Hato Rey, Puerto Rico: Editorial Universitaria, Universidad de Puerto Rico.

Hayes, Bruce (1989). Compensatory lengthening in moraic phonology. *Linguistic Inquiry*, *20*, 253-306.

Hoffman, Michol (2001). Salvadoran Spanish /-s/ aspiration and deletion in a bilingual context. *University of Pennsylvania Working Papers in Linguistics*, *7*(3), 115-127.

Howard, Martin (2012). The advanced learner's sociolinguistic profile: On issues of individual differences, second language exposure conditions, and type of sociolinguistic variable. *Modern Language Journal*, *96*(1), 20-33.

Jia, Gisela, Strange, Winifred, Wu, Yanhoung, Collado, Julissa, & Guan, Qi (2006). Perception and production of English vowels by Mandarin speakers: Age-related differences vary with amount of L2 exposure. *The Journal of the Acoustical Society of America*, *119*(2), 1118-1130.

Johnson, Daniel E. (2009). Getting off the Goldvarb standard: Introducing Rbrul for mixed-effects variable rule analysis. *Language and Linguistics Compass*, *3*(1), 359–383.

Kim, Ji-Young (2012, February). *Discrepancy between the perception and production of stop consonants by Spanish heritage speakers in the United States*. Paper presented at Current Approaches to Spanish & Portuguese Second Language Phonology, University of South Carolina, Columbia, SC.

Kim, Ji-Young (2015). Perception and production of Spanish lexical stress by Spanish heritage speakers and English L2 learners of Spanish. In Erik W. Willis, Pedro Martín Butragueño, & Esther Herrera Zendejas (Eds.), *Proceedings of the 6th Conference on Laboratory Approaches to Romance Phonology* (pp. 106-128). Somerville, Massachusetts: Cascadilla Proceedings Project.

Labov, William (1972). *Sociolinguistic patterns*. Philadelphia, Pennsylvania: University of Pennsylvania Press.

Labov, William (2010). Words floating on the surface of sound change. In *Principles of linguistic change, Volume 3: Cognitive and cultural factors* (pp. 261-286). Malden, Massachusetts: Wiley-Blackwell.

Lafford, Barbara (1986). Valor diagnóstico-social del uso de ciertas variantes de /s/ en el español de Cartagena, Colombia. In Rafael. A. Núñez Cedeño, Iraset Páez Urdaneta & Jorge M. Guitart (Eds.), *Estudios sobre la fonología del español del Caribe* (pp. 53-75). Caracas, Venezuela: La Casa de Bello.

Lafford, Barbara (1989). Is functionalism a fact?: Data from the Caribbean. *Hispanic Linguistics*, *3*(1), 49-74.

Levelt, Willem J. M. (1989). *Speaking: From intention to articulation*. Cambridge, Massachusetts: MIT Press.

Lipski, John (1984). On the weakening of /s/ in Latin American Spanish. *Zeitschrift für Dialektologie und Linguistik*, *51*(1), 31–43.

Lipski, John (1985). /s/ in Central American Spanish. *Hispania*, *68*(1), 143–149.

Lipski, John (1999). The many faces of Spanish /s/-weakening: (Re)alignment and ambisyllabicity. In Javier Gutierrez-Rexach & Fernando Martínez-Gil (Eds.), *Advances in Hispanic linguistics* (pp. 198-213). Somerville, Massachusetts: Cascadilla Press.

Martínez-Sanz, Cristina, & van Herk, Gerard (2013, May). Saying nothing: Frequency effects in Dominican Spanish null subjects. Paper presented at *Conference on Change and Variation in Canada*, Toronto.

Major, Roy C. (2004). Gender and stylistic variation in second language phonology. *Language Variation and Change, 16*(3), 164-188.

Moreno, Kristen H. (2009). *The study abroad experiences of heritage language learners: Discourses of identity*. Unpublished doctoral dissertation, University of Texas, Austin.

Mougeon, Raymound, Rehner, Katherine, & Nadasdi, Terry (2004). The learning of spoken French variation by immersion students from Toronto, Ontario. *Journal of Sociolinguistics, 8*(3), 408-432.

Muniandy, Mohan, Nair, Gopala K. S., Krishnan, Shashi K., Ahmad, Irma, & Noor, Norashikin B. M. (2010). Sociolinguistic competence and Malaysian students' English language proficiency. *English Language Teaching, 3*(3), 145-151.

Norton, Bonny (2013). *Identity and language learning: Extending the conversation*. Bristol, United Kingdom: Multilingual Matters.

Ortega-Llebaria, Marta, & Prieto, Pilar (2007). Disentangling stress from accent in Spanish: Production patterns of the stress contrast in deaccented syllables. In Pilar Prieto, Joan Mascaró, & Maria-Josep Solé (Eds.), *Segmental and prosodic issues in Romance phonology* (pp. 155–176). Amsterdam/Philadelphia: John Benjamins.

Rubin, Kyna (2004). Going "home" to study. *International Educator*, *13*, 26-33.

Parra, María Luisa (2016). Understanding identity among Spanish heritage learners. An interdisciplinary endeavor. In Diego Pascual y Cabo (Ed.), *Advances in Spanish as a heritage language* (pp. 178-205). Amsterdam/Philadelphia: John Benjamins.

Parrell, Benjamim (2011). The role of gestural phasing in western Andalusian Spanish aspiration. *Journal of Phonetics, 40*, 37–45.

Pearson Education (2011). Versant Spanish test: Test description and validation summary. http://www.versanttest.com/technology/VersantSpanishTestValidation.pdf.

Petrucci, Peter (2007). Heritage learners in the ancestral homeland: An overlooked identity in study abroad research. *Sociolingusitic Studies*, *1*(2).

Polinsky, Maria, & Kagan, Olga (2007). Heritage languages: In the 'wild' and in the classroom. *Language and Linguistics Compass, 1*(5), 368-395.

Poplack, Shana (1980). Deletion and disambiguation in Puerto Rican Spanish. *Language*, 56(2), 371-385.

Poplack, Shana (1986). Acondicionamiento gramatical de la variación fonológica en un dialecto puertorriqueño. In Rafael Núñez-Cedeño et al. (Eds.), *Estudios sobre la fonología del español del Caribe*, (pp. 95-107). Caracas, Venezuela: La Casa de Bello.

Potowski, Kim (2002). Experiences of Spanish heritage speakers in university foreign language courses and implications for teacher training. *ADFL Bulletin*, *33*(3), 35-42.

Potowski, Kim (2013). Heritage learners of Spanish. In Kimberly L. Geeslin (Ed.), *The handbook of Spanish second language acquisition* (pp. 404–422). New York, New York: Wiley.

R Core Team (2013). R: A language environment for statistical computing. R foundation for statistical computing, Vienna, Austria. http://www.R-project.org/.

Rasmussen, Jennifer, & Zampini, Mary (2010). The effects of phonetics training on the intelligibility and comprehensibility of native Spanish speech by second language learners. In John Levis & Kimberly LeVelle (Eds.), *Proceedings of the 1st Pronunciation in Second Language Learning and Teaching Conference* (pp. 38–52). Ames, Iowa: Iowa State University.

Riegelhaupt, Florecia, & Carrasco, Roberto Luis (2000). Mexico host family reactions to a bilingual Chicana teacher in Mexico: A case study of language and culture clash. *Bilingual Research Journal*, *24*(4), 405-421.

Ruíz-Sánchez, Carmen (2004). El comportamiento de la /s/ implosiva en el habla de Caracas. *Boletín de Lingüística, 21*, 48-65.

Sankoff, David, Tagliamonte, Sali A., & Smith, Eric (2005). *Goldvarb X: A multivariate analysis application* (Computer Program). Toronto and Ottawa: Department of Linguistics, University of Toronto and Department of Mathematics, University of Ottawa.

Santilli, Michael D. (1996). *Teacher talk and written materials in the Spanish as a second language classroom and their importance as input for second language acquisition*. Unpublished doctoral dissertation, University of Illinois at Urbana-Champaign.

Schmidt, Lauren B. (2009). The effect of dialect familiarity via a study abroad experience on L2 comprehension of Spanish. In Joseph Collentine, Maryellen García, Barbara Lafford, & Francisco Marcos Marín (Eds.), *Selected proceedings of the 11th Hispanic Linguistics Symposium* (pp. 143-154). Somerville, Massachusetts: Cascadilla Proceedings Project.

Schmidt, Lauren B. (2011). *Acquisition of dialectal variation in a second language: L2 perception of aspiration of Spanish /s/.* Unpublished doctoral dissertation, University of Indiana, Bloomington.

Schmidt, Lauren B. (2015). Not all forms of dialect contact are the same: Effects of regional media, travel, and social contacts on the perception of Spanish aspirated-/s/. *Borealis – An International Journal of Hispanic Linguistics*, *4*(1), 99-120.

Shively, Rachel (2016). Heritage language learning in study abroad: Motivations, identity work, and language development. In Diego Pascual y Cabo, *Advances in Spanish as a heritage language* (pp. 259-80). Amsterdam/Philadelphia: John Benjamins.

Tamminga, Meredith (2014). Sound change without frequency effects. In Robert. E. Santana-LaBarge (Ed.), *Proceedings of the 31st West Coast Conference on Formal Linguistics* (pp. 457-465). Somerville, Massachusetts: Cascadilla Proceedings Project.

Tarone, Elaine E. (1988). *Variation in interlanguage*. London, United Kingdom: Edward Arnold.

Terrell, Tracy. (1978). Sobre la aspiración y elisión de /s/ implosiva y final en el español de Puerto Rico. *Nueva Revista de Filología Hispánica*, *27*(1), 24-38.

Terrell, Tracy (1979). Final /s/ in Cuban Spanish. *Hispania*, *62,* 599-612.

Terrell, Tracy (1981). Diachronic representation by dialect comparison of variable constraints: s-aspiration and deletion in Spanish. In David Sankoff & Henrietta Cedergren (Eds.), *Variation omnibus* (pp. 115-124). Carbondale, Illinois: Linguistic Research.

Torreira, Francisco (2006). Coarticulation between aspirated-s and voiceless stops in Spanish: An interdialectal comparison. In Nuria Sagarra & Almeida Jacqueline Toribio, (Eds.), *Selected proceedings of the 9th Hispanic Linguistics Symposium* (pp. 113-20). Somerville, Massachusetts: Cascadilla Press.

Torreira, Francisco (2007). Pre- and postaspirated stops in Andalusian Spanish. In Pilar Prieto, Joan Mascaró, & Maria-Josep Solé (Eds.), *Segmental and prosodic issues in romance phonology* (pp. 67-82). Amsterdam/Philadelphia: John Benjamins.

Torreira, Francisco (2012). Investigating the nature of aspirated stops in western Andalusian Spanish. *Journal of the International Phonetic Association, 42*, 49–63.

Trimble, John C. (2011, October). The intelligibility of Spanish dialects from the L2 learner's perspective: The importance of phonological variation and dialect familiarity. Paper presented at the 2010 Hispanic Linguistics Symposium, Bloomington, Indiana.

Tsukada, Kimiko, Birdsong, David, Bialystok, Ellen, Mack, Molly, Sung, Hyekyung, & Flege, James E. (2005). A developmental study of English vowel production and perception by native Korean adults and children. *Journal of Phonetics*, *33*, 263-290.

Van Der Meid, J. Scott (2003). Asian Americans: Factors influencing the decision to study abroad. *Frontiers: The Interdisciplinary Journal of Study Abroad*, *9*, 71-110.

Young, Richard (1991). *Variation in interlanguage morphology*. New York, New York: Peter Lang.

Chelsea Escalante, University of Wyoming
cescalan@uwyo.edu

EN Chelsea Escalante (Ph.D., University of California, Davis) is an Assistant Professor of Spanish and Applied Linguistics at the University of Wyoming. Her research agenda is primarily focused on sociolinguistic approaches to second language and heritage language development. She has published in journals such as *American Speech, Divergencias, Entrehojas,* and *Normas: Revista de Estudios Lingüísticos Hispánicos* and has presented at numerous national and international conferences.

ES Chelsea Escalante obtuvo su doctorado en la University of California, Davis, y profesora contratada de español y lingüística aplicada en la University of Wyoming. Su agenda investigadora se centra sobre todo en los enfoques sociolinguisticos aplicados al desarrollo de segundas lenguas y lenguas de herencia. Ha publicado en revistas como por ejemplo *American Speech, Divergencias, Entrehojas* y *Normas: Revista de Estudios Lingüísticos Hispánicos* y ha presentado sus trabajos en numerosas conferencias nacionales e internacionales.

IT Chelsea Escalante ha ottenuto il dottorato di ricerca presso la University of California, Davis, ed è ricercatrice universitaria di spagnolo e linguistica applicata presso la University of Wyoming. La sua attività di ricerca si svolge principalmente nell'ambito degli approcci sociolinguistici applicati alle lingue seconde ed ereditarie. Ha pubblicato in riviste come *American Speech, Divergencias, Entrehojas* e *Normas: Revista de Estudios Lingüísticos Hispánicos* e ha presentato il suo lavoro in numerose conferenze nazionali e internazionali.